A Framework for Assisting the Design of Effective Implementation Strategies for Software Process Improvement

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CERTIFICATE OF AUTHORITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated and referenced in the thesis.

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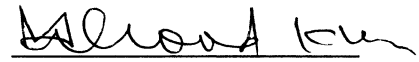

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CBs	Critical Barrier
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
CSFs	Critical Success Factors
IMM	Implementation Maturity Model
ISO	International Standard Organization
IT	Information Technology
KPA	Key Process Area
PA	Process Area
SCE	Software Contractor Evaluation
SEI	Software Engineering Institute
SMEs	Small and Medium Enterprises
SPA	Software Process Assessment
SPI	Software Process Improvement
SPI-IF	SPI Implementation Framework
SPI-IM	SPI Implementation Model

Dedication

To my uncle Abdul Saboor Khan and my parents, Ghulam Rasool Niazi and Zakia Khanum, for making this possible...

Abstract

This research addresses issues relating to the implementation of software process improvement (SPI) initiatives. A number of advances have been made in the development of software process improvement (SPI) standards and models, e.g. Capability Maturity Model (CMM), more recently CMMI, and ISO's SPICE. However, these advances have not been matched by equal advances in the adoption of these standards and models in software development which has resulted in limited success for many SPI efforts. The current problem with SPI is not a lack of standards or models, but rather a lack of an effective strategy to successfully implement these standards or models.

Despite the importance of the SPI implementation process, little empirical research has been carried out on developing ways in which to effectively implement SPI initiatives. I have focused on SPI implementation issues and designed three individual components in order to assist SPI practitioners in the design of effective SPI implementation initiatives. I have combined individual components under one SPI implementation framework (SPI-IF) using a bottom-up approach. The framework is based on results drawn from the SPI literature and an empirical study I have carried out. In the design of SPI-IF, the concept of critical success factors (CSFs) is used and extended. Thirty-four CSF interviews were conducted with Australian practitioners. In addition, 50 research articles (published experience reports and case studies) were selected and analysed in order to identify factors that play positive or negative roles in SPI implementation. The SPI-IF has three components: SPI implementation factors component, assessment

component and implementation component. It provides a practical structure with which to assess and implement SPI implementation initiatives.

In order to evaluate the software process improvement implementation framework, two practical evaluations were undertaken: three case studies and an expert panel review process. The case study method was used because this method provides valuable insights for problem solving, evaluation and strategy in the real world environment. An "expert panel review" process was also conducted in order to seek the opinions of SPI experts about the structure and components of the SPI-IF.

In order to provide more confidence in this study, three separate case studies were conducted at different companies. The results of the case studies showed that the SPI-IF is not only significant in the theoretical sense but also significant in a real world environment. Successful completion of the three case studies demonstrates the use of the SPI-IF in the real world environment. All the participants who used the SPI-IF were fully satisfied with the assessment results and overall performance of the framework.

The results of the expert panel review process showed that the SPI experts' general impression about 'ease of learning', 'user satisfaction' and 'structure of the SPI-IF' was positive. Overall, the experts were fully satisfied with the different components of SPI-IF. All the experts considered this piece of work as useful for the SPI practitioners. They have also confirmed the SPI-IF as a valuable framework that has the potential to assist SPI practitioners in the design of SPI implementation initiatives.